**TEMPLATE FOR COURSE SPECIFICATION**

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| HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW |

 **COURSE SPECIFICATION**

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| This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the program specification.  |

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| College of EngineeringUniversity of Baghdad | 1. Teaching Institution |
| Environmental Engineering Department | 2. University Department/Centre |
| Numerical Analysis EnE 302This course introduce the followings:Approximation and round of errors, roots of equations, interpolation, linear algebraic equations, curve fitting, Numerical differentiation and integration, ordinary differential equation, advanced numerical differentiation and numerical integration, partial differential equations, solution of set of partial differential equations, numerical solution of partial differential equations (elliptic, parabolic, hyperbolic), parabolic equations in two spatial dimensions, numerical solution of nonlinear equations, applications. | 3. Course title/code and description |
| Environmental Engineering Department | 4. Program (s) to which it contributes |
| Annual System: There is only one mode of delivery, which is a “Day Program”. The students are full time students, and on campus. They attend full day program in face-to-face mode. The academic year is composed of 30-weeks regular subjects. | 5. Modes of Attendance offered |
| 1st and 2nd / Academic Year 2013-2014 | 6. Semester/Year |
| 90 hrs./ 3 hrs per week | 7. Number of hours tuition (total) |
| May 1st , 2014 | 8. Date of production/revision of this specification  |
| **9. Aims of the Course** |
| The student will be capable of solving the mathematical models that represent different physical and engineering models numerically and find the best fit to the experimental data and widened the engineering imageof the student. |

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| **10· Learning Outcomes, Teaching ,Learning and Assessment Method**1. Study the effect of types of errors in numerical solutions.
2. Understand the methods used in root finding.
3. Use close and open methods in root finding.
4. Analyze and understand the direct and indirect methods of linear simultaneous equations.

.1. Implement the interpolation and Lagrange’s Interpolation.
2. Solution of system non linear equations.
3. Mathematical understanding of ordinary differential equations, and the numerical solution of initial value problems (IVP).
4. Using different methods in solving differential equations.
5. Understand the principle of forward, backward, central finite differences.
6. Solution of ordinary differential equation by finite differences.
7. Study the advanced differentiation and integration.
8. Using numerical solution of partial differential equations (elliptic, parabolic, hyperbolic) in different applications
9. Solution of field problems in two spatial dimensions.
10. Understand some basic Environmental Engineering Problems.
11. Use curve fitting in field applications
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| ***11. Teaching and Learning Methods***1- Lectures.2- Tutorials.3- Homework and Assignments.4- Computer Lab. Applications.5- Tests and Exams.6- In-Class Questions and Discussions.7- Connection between Theory and Application.9- Extracurricular Activities.11- In- and Out-Class oral conservations. |
| ***12. Assessment Methods***1. Examinations, Tests, and Quizzes.2. Extracurricular Activities.3. Student Engagement during Lectures.4. Responses Obtained from Students, Questionnaire about curriculum and faculty member (Instructor) |

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| ***13. Grading Policy***1. Quizzes: - There will be four quizzes during the academic semester. The quizzes will count 5% of the total course grade.  2. Exams: - There will be three closed books and notes exam during the academic year, The mid-term exam will count 20% of the total course grade. 3. HomeworkThere will be homework after each week and will account 5% of the total course grade7. Final Exam:  - The final exam will be comprehensive, closed books and notes,  The final exam will count 70% of the total course grade.  |

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| 14. Course Structure |
| Assessment Method | TeachingMethod | Unit/Module or Topic Title | ILOs | Hours | Week |
| 1 – 4 of article (12) | 1-11 ofarticle (11) | Approximation and round of errors | a, b, c, d, e, f, g, h ,I ,j, k, l, m, n, o | 2 (Theo.) + 1 (Tutorial.) | 1 |
| 1 – 4 of article (12) | 1-11ofarticle (11) | Approximation and round of errors | a, b, c, d, e, f, g, h ,I ,j, k, l, m, n, o | 2 (Theo.) + 1 (Tutorial.) | 2 |
| 1 – 4 of article (12) | 1-11 ofarticle (11) | Roots of equations | a, b, c, d | 2 (Theo.) + 1 (Tutorial.) | 3 |
| 1 – 4 of article (12) | 1-11 ofarticle (11) | Roots of equations | a, b, c, d | 2 (Theo.) + 1 (Tutorial.) | 4 |
| 1 – 4 of article (12) | 1-11ofarticle (11) | , interpolation | a, e, i | 2 (Theo.) + 1 (Tutorial.) | 5 |
| 1 – 4 of article (12) | 1-11 ofarticle (11) | Linear algebraic equations | a, b, c, d | 2 (Theo.) + 1 (Tutorial.) | 6 |
| 1 – 4 of article (12) | 1-11 ofarticle (11) | Linear algebraic equations | a, b, c, d | 2 (Theo.) + 1 (Tutorial.) | 7 |
| 1 – 4 of article (12) | 1-11 ofarticle (11) | Curve fitting | a, e, f, o | 2 (Theo.) + 1 (Tutorial.) | 8 |
| 1 – 4 of article (12) | 1-11 ofarticle (11) | Curve fitting | a, e, f, o | 2 (Theo.) + 1 (Tutorial.) | 9 |
| 1 – 4 of article (12) | 1-11 ofarticle (11) | Numerical differentiation | a, g, h, i, j | 2 (Theo.) + 1 (Tutorial.) | 10 |
| 1 – 4 of article (12) | 1-11 ofarticle (11) | Numerical differentiation problems | a, g, h, i, j | 2 (Theo.) + 1 (Tutorial.) | 11 |
| 1 – 4 of article (12) | 1-11 ofarticle (11) | Numerical Integration | a, h, i | 2 (Theo.) + 1 (Tutorial.) | 12 |
| 1 – 4 of article (12) | 1-11 ofarticle (11) | Ordinary differential equations | a, g, h, i, j | 2 (Theo.) + 1 (Tutorial.) | 13 |
| 1 – 4 of article (12) | 1-11 ofarticle (11) | Ordinary differential equations | a, g, h, i, j | 2 (Theo.) + 1 (Tutorial.) | 14 |
| 1 – 4 of article (12) | 1-11 ofarticle (11) | Advance numerical differentiation | a, k | 2 (Theo.) + 1 (Tutorial.) | 15 |
| 1 – 4 of article (12) | 1-11 ofarticle (11) | Advance numerical differentiation | a, k | 2 (Theo.) + 1 (Tutorial.) | 16 |
| 1 – 4 of article (12) | 1-11 ofarticle (11) | Advance numerical integration | a, k | 2 (Theo.) + 1 (Tutorial.) | 17 |
| 1 – 4 of article (12) | 1-11 ofarticle (11) | Advance numerical integration | a, k | 2 (Theo.) + 1 (Tutorial.) | 18 |
| 1 – 4 of article (12) | 1-11 ofarticle (11) | Partial differential equations | a, k, j | 2 (Theo.) + 1 (Tutorial.) | 19 |
| 1 – 4 of article (12) | 1-11 ofarticle (11) | Partial differential equations | a, k, j | 2 (Theo.) + 1 (Tutorial.) | 20 |
| 1 – 4 of article (12) | 1-11 ofarticle (11) | Solution of set of partial differential equations | a, k, j | 2 (Theo.) + 1 (Tutorial.) | 21 |
| 1 – 4 of article (12) | 1-11 ofarticle (11) | Numerical solution of partial differential equations | a, k, j | 2 (Theo.) + 1 (Tutorial.) | 22 |
| 1 – 4 of article (12) | 1-11 ofarticle (11) | Numerical solution of partial differential equations (elliptic) | a, j, k, l, m, n | 2 (Theo.) + 1 (Tutorial.) | 23 |
| 1 – 4 of article (12) | 1-11 ofarticle (11) | Numerical solution of partial differential equations(parabolic) | a, j, k, l, m, n | 2 (Theo.) + 1 (Tutorial.) | 24 |
| 1 – 4 of article (12) | 1-11 ofarticle (11) | Numerical solution of partial differential equations(hyperbolic) | a, j, k, l, m, n | 2 (Theo.) + 1 (Tutorial.) | 25 |
| 1 – 4 of article (12) | 1-11 ofarticle (11) | Parabolic equations in two spatial dimensions | a, j, k, l, m, n | 2 (Theo.) + 1 (Tutorial.) | 26 |
| 1 – 4 of article (12) | 1-11 ofarticle (11) | Numerical solution of nonlinear equations | a, j, k, l, m, n | 2 (Theo.) + 1 (Tutorial.) | 27 |
| 1 – 4 of article (12) | 1-11 ofarticle (11) | Numerical solution of nonlinear equations | a, j, k, l, m, n | 2 (Theo.) + 1 (Tutorial.) | 28 |
| 1 – 4 of article (12) | 1-11 ofarticle (11) | Applications | a, b, c, d, e, f, g, h ,I ,j, k, l, m, n, o | 2 (Theo.) + 1 (Tutorial.) | 29 |
| 1 – 4 of article (12) | 1-11 ofarticle (11) | Applications | a, b, c, d, e, f, g, h ,I ,j, k, l, m, n, o | 2 (Theo.) + 1 (Tutorial.) | 30 |

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| 15. Infrastructure |
| Text Book:1- George W. and Collins, II, 2003, Fundamental Numerical Methods and Data Analysis. References1-Steven C. Chapra, and Raymond P. Canale, 2006, Numerical Methods for Engineers, Fifth Edition, McGraw Hill.1- N. S. Asaithambi , Numerical analysis theory and practice2- James L. Bauchanan and Turner ,Numerical methods and analysis 3- J.B. Dixtt, 2010, Numerical Methods  | Required reading:· CORE TEXTS· COURSE MATERIALS· OTHER |
| Available electronic books related to the subject.Extracurricular activities. | Special requirements (include for example workshops, periodicals, IT software, websites) |
| Computer applications using MATLAB in the computer Laboratory. | Community-based facilities(include for example, guestLectures , internship , field studies) |

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| 16. Admissions |
| EnE 101, EnE 106, EnE 202, EnE 208 | Pre-requisites |
| / | Minimum number of students |
| 16 | Maximum number of students |
| **Instructor: Assistant Prof. Dr. Shahlaa Esmail Ebrahim**Water Pollution and Hazardous Waste ManagementEnvironmental Engineering DepartmentCollege of EngineeringUniversity of BaghdadCell phone: 009647901798098E-mail: shahlaa.ebrahim@fulbrightmail.orgOr shahlaaaga@gmail.com | 17. Course Instructor |